

Physical-Chemical and Microbiological Study of Sourmilk (*Pendidam*)

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Abstract

Pendidam is a fermented milk drink found in the Cameroonian market both in the Adamawa and North-West provinces. It is produced from the spontaneous fermentation of fresh raw milk followed by churning of the cream in order to obtain butter the most important product of the process. The objective of this work was to determine the physico-chemical properties of *pendidam* in two different regions of Cameroon and the microbial counts for public health reasons. Results showed that *pendidam* from the Adamawa contains 82.36g/l Dry matter, 4.2 - 3.5 pH, 87.81 °SH titratable acidity, 1.43% butterfat and a density of 1.030 while the corresponding values for the samples from the North-West were 86.90g/l dry matter, 4.2 - 3.85 pH, 53.76 °SH titratable acidity, 1.86% butterfat and a density of 1.030.

Titratable acidity and butterfat differed significantly ($P < 0.05$) between the two provinces. The densities however were the same.

Microbiologically, the mean AMC in North-West were in the range 1.11×10^9 cfu/ml as compared to 5.75×10^6 cfu/ml in the samples from Adamawa. All the samples contained coliforms which supports the fact that the product requires pasteurisation before consumption.

Introduction

Fermented milk is consumed in Cameroon and all over the Savannah of West Africa and Northern African by the Negro and Berber people of West Africa (Kosikwoski 1982).

Sour milk (*Pendidam*) is a fermented milk product produced from the spontaneous fermentation of fresh raw whole milk which has been left overnight until coagulation takes place and the cream removed and churned to make butter. It is a product which comes from the traditional production of butter.

The preparation is carried out at the family level. After the morning milking the surplus milk is left covered in a bowl until the following day or until coagulation takes place at ambient temperature. The duration depends upon the season. The coagulated milk is then skimmed, the cream fraction transferred into a gourd and then rocked back and forth on a thick piece of cushion until the cream sets. This is the end of the churning process which takes between 30 to 40 minutes approximately depending on the volume of cream. After churning the butter grains are collected together with a calabash spoon (*Hordu*), then the buttermilk is strained with a sieve into another large container ready for consumption or sale. The butter is washed with clean water at ambient temperature three to four times. The water is not usually portable.

After washing the butter it is transferred

into the bowl of *pendidam* (sour milk) covered in a calabash bowl of about 40 to 50 cm diameter and sold simultaneously. The butter is made into balls and put in the sour milk. It must be emphasised that this product is mostly available for sale during the rainy season when there is surplus milk.

The objective of this work was to determine the physico-chemical and microbiological qualities which influence the development of flavour and texture of *pendidam* from two highland regions of Cameroon for possible development potential, that even though have similar vegetations but differ in rainfall - with the North-West having a rainfall of about 2500mm per annum and the Adamawa having about 1000 mm per annum.

Materials and Methods

Description of sites:

Investigations took place in two sites: The Adamawa province and the Western highlands of Cameroon. Table 1 shows the characteristics of the two agro-ecological zones:

The two agro-ecological differ in their Altitude, Rainfall and in their Relative humidity. These two zones are similar in terms of their average annual temperatures.

The vegetation in the Adamawa province is dominated by *Hyparrhenia rufa*, while

the western highlands is covered mainly by *Sporobolus africanus*.

Sample collection and Analysis:

A total of 53 samples of *pendidam*, 26 from Adamawa and 27 from the Western highlands of Cameroon, were collected from local markets. Samples were collected in sterilized sampling bottles tightly plugged with cotton wool and Aluminium foil. They were analysed in the Dairy Technology Laboratory. Samples from Adamawa were transported in a cooler and kept under refrigeration prior to analyses. The samples from Western highlands were collected and analysed after two days under refrigeration.

Samples were analysed for dry matter, titratable acidity, butterfat, moisture content and density, following methods described by Egan *et al* (1983).

Microbiologically, Aerobic Mesophilic counts (AMC) and Coliform Counts (CC) were carried out using the pour plate technique and dilutions in one-quarter ringers up to 10^{-7} ; and plating with Plate count agar or Violet Red Bile Glucose agar then incubating at 30°C and 37°C respectively; (Harrigan and McCance, 1976).

Data were compared between the two provinces using the t-test.

Table 1: Climatic characteristics of the Adamawa and the Western highlands of Cameroon

	Adamawa	Western Highlands
Altitude (m)	1.100	1.510
Rainfall (mm)	1,523.8 ± 143.0	3,311.0 ± 196.0
Temperature (°C)	22.0 ± 1.4	20. ± 1.2
Relative humidity (%)	67.3 ± 14/0	73.3 ± 12.4
Length of dry season	October to March	November to February

Source: Research and Development (Cameroon, 1988).

Table 2. Physical-Chemical properties of *pendidam* from Adamawa

	Range	Mean	Standard Deviation
Dry Matter (g/l)	74.8 - 98.3	82.36	7.04
Titrateable acidity (°SH)	89.0 - 113.0	87.81	19.03
pH	4.2 - 3.5	3.85	0.62
Moisture Content (g/l)	901.7 - 924.9	916.87	0.716
Butterfat (%)	1.1 - 2.1	1.43	0.34
Density	1.027 - 1.033	1.030	0.003

Table 3. Physical-Chemical properties of *pendidam* from Western Highlands

	Range	Mean	Standard Deviation
Dry Matter (g/l)	80.70 - 91.30	86.90	3.78
Titrateable acidity (°SH)	30.0 - 85.80	53.76	18.81
pH	4.2 - 3.85	4.05	0.44
Moisture Content (g/l)	825.6 - 943.8	888.8	2.87
Butterfat (%)	1.0 - 4.1	1.86	0.79
Density	1.023 - 1.034	1.030	0.009

Table 4. Microbiological counts from Adamawa and Western Highlands

	Adamawa	North-West	Adamawa	North-West
	AMC (cfu/ml)	AMC (cfu/ml)	CC (cfu/ml)	CC (cfu/ml)
Range	0.1 x 10 ⁶ - 11.5 x 10 ⁶	0.21 x 10 ⁹ - 2.02 x 10 ⁹	0.1 x 10 ³ - 1.3 x 10 ³	1 x 10 ² - 31.2 x 10 ⁵
Mean	5.75 x 10 ⁶	1.11 x 10 ⁹	0.6 x 10 ³	1.61 x 10 ⁴
Standard Deviation	1.15	0.90	0.12	16.52

Results and Discussion

Table 2 and 3 show the results of the physico-chemical properties of *pendidam* from Adamawa and Western Highlands (WH) respectively.

The dry matter content of *pendidam* were 82.36g/l ± 7.04 and 86.9g.l ± 3.78 for samples from Adamawa and (WH) respectively, (Tables 2 & 3). For both regions the dry matter was lower than the mean DM obtained for *iben* of Morocco (87.9g/l -

Tantaoui *et al*, 1983; and 88.9 g/l - Boubekri *et al* 1984) The moisture contents ranged from the NW ranged from 825.6 to 943.8 with an average of 888.8g/l. From this result it appears that *pendidam* from the NW was heavier than that from Adamawa, but this was not the case. The presence of coliforms whose role is to reduce the lactose to produce other compounds could be responsible for this change in texture.

The titrateable acidity which describes the

degree of free (H⁺) present in the samples and hence its content of acid was 87.81°SH and 53.76°SH for Adamawa and NW samples respectively. These values indicate that samples from Adamawa were more acidic than those from NW. This could be explained by the duration of fermentation during storage of the samples before analysis. It is important to note that the fermentation is not stopped before consumption. Fermentation of milk results in the production of lactic acid, which has the effect of lowering the pH and thereby arresting any further development of germs or other toxic microorganisms. It also has some killing and destructive effect on bacteria and also arresting bacterial multiplication besides giving the final product its physiological characteristics. In a recent study on *pendidam* from the NW Tiku and Fru, 1998 revealed a titrateable acidity of between 21.07 and 70.29 °SH and a pH of between 5.20 and 3.85 which agrees with these results. The pH ranged from 4.2 - 3.5 in the Adamawa and 4.2 - 3.85 in the NW showing some production of acid during the fermentation. This range of pH is within that obtained by Jiwoua and Milliere (1990) while working on *pendidam* the Adamawa (3.55 and 3.94)

The average butter fat content was 1.43 ± 0.34% and 1.86 ± 0.79% for samples from Adamawa and NW respectively. The low butterfat is not unexpected as the technology involved in the production of *pendidam* is primarily that of butter-making for this is the most valuable item in the milk as far as the Fulanis and Mborros' are concerned. Tiku and Fru in an earlier study on *pendidam* from the NW found the butterfat was much higher than these figures of up to 4.1% and 2.2% in some areas. But figures obtained here are high compared to those of a similar product *iben* of Morocco (0.89%); Boubekri *et al* (1984). It can be concluded that the churning process is not efficient enough since the butterfat is the most valuable ingredient of the processing.

The densities were similar in both areas, in which case the viscosity were almost the same but not significantly different from that of fresh milk which was 1.029.

When the microbiological quality was examined, it was observed that samples from NW contained more AMC (10⁹ cfu/ml) than those from the Adamawa (10⁶ cfu/ml) as seen in Table 4. This is

probably due to the freshness of the samples because the more aged the fermenting milk is, the more acid it becomes, consequently, the fewer the AMC. In a previous study on *pendidam* from the Adamawa, Jiwoua and Milliere (1990) also obtained AMC counts in the range of 10^6 - 10^8 cfu/ml. These results also agree with those obtained in Morocco for *iben* 10^8 cfu/ml (Benkerroum et al 1984). From Table 4 the presence and levels of coliforms (10^5 cfu/ml) suggest a need for some form of process treatment to reduce or eliminate coliforms during production. Eka and Ohaba (1977) while working on *nono* in Nigeria found coliforms in the level of 10^5 higher than that obtained in this study (10^3 and 10^4 cfu/ml) while the AMC of 6.7×10^6 cfu/ml agrees with that of *pendidam*. Benkerroum et al (1984) found a coliform count of 6.99×10^4 cfu/ml in *iben* of Morocco which is similar to results obtained here.

Conclusion

This study suggests that *Pendidam* collected from the Adamawa and the

Western highlands of Cameroon have similar properties in term of pH and density. But they differ widely in terms of Titratable acidity, Dry matter, Butter fat and Moisture content. It is suggested that *Pendidam* be pasteurised before drinking because of its high coliform count.

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References

- Benkerroum N. Tantaoui-Elaraki A. EL Marrachi A. (1984) Hygienic quality of Moroccan *Iben*. Microbiology - Foods and Feeds - Nutrition 2, 199 - 206
- Boubekri C., Tantaoui - Elaraki A., Berrada M. and Benkerroum N. (1984) Caracterisation physicochimique du *Iben* moracain. Le lait, 64, 436-447.
- Eka O. U. and Ohaba J. A. (1977). Microbiological examination of Fulani milk

(*nono*) and butter (*man shanu*). Nigerian Journal of Science Vol 11 No. 1 & 2, 113 - 122.

Harrigan W. F. and McCance M. E. (1976). Laboratory Methods in Food and dairy microbiology, London.

Jiwoua C. and Milliere J. B. 1990. Lactic flora and *Enterococci* of fermented milk *Pendidam* (produced in Adamawa Cameroon). Le lait 70, 475 - 486.

Kosikowski V. F. (1982). Cheese and Fermented products, revised Ed. Brooketonale, New York, Edwards Brothers, Inc. Ann. Arbor Michigan.

Harold Egan, Ronald S. Kirk and Ronald Sawyer. (1983). Pearson's Chemical Analysis of Foods, Longman Scientific & Technical 8th Edition.

Tantaoui - Elaraki, A., M. Berrada, A. El. Marrakchi et A. Berramou. (1983). Etude sur le *Iben* moracain. Le Lait, 63, 230 - 245.

Tiku Kanga P. and Fon S. F. (1998) A study of the physico-chemical and microbiological properties of *pendidam* from four different locations around Bamenda. (Presented at 6th Biosciences conference in Buea from 09/12/98 - 11/12/98).